Developing Zynq Software with Xilinx SDK

Lab 1

Explore a Zynq Hardware Platform

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Version 09

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Lab 1 Overview

Zynq®-7000 All Programmable SoC application development starts with a Zynq Hardware Platform. This hardware platform defines how the ARM Processing System (PS) is configured as well as providing the actual hardware design itself for the Programmable Logic (PL). This hardware platform must be configured, designed, and built in Vivado® Design Suite. Upon completion of this build process, the results may be exported out of Vivado for use in the Xilinx Software Development Kit (SDK).

This course focuses on the software application development in SDK, so we will make use of a Zynq hardware platform that was previously designed and built in Vivado and then exported for SDK use. For additional instruction on how to design the Zynq hardware platform, please attend the *Developing Zynq-7000 AP SoC Hardware*.

The hands-on labs for this SpeedWay course follow the Xilinx guidelines provided as part of UltraFast Design Methodology. The term methodology can mean different things to different people. Flow charts, methods, principles, rules, and policies are among several possible themes. The UltraFast Design Methodology guide does not illustrate a step-by-step process for success. Instead, the goal is to equip designers with information and guidance on designing embedded systems so that they can make informed decisions when using the tool box. Some content applies generally to embedded systems, while other content is specific to the Xilinx® All-Programmable SoC products. For more information on the benefits of UltraFast Design Methodology, please refer to the Xilinx User Guide documents UG949 and UG1046. Links to these two documents are provided at the end of this lab.

Before performing software application development in SDK, it is worthwhile to understand what the hardware platform archive contains.

Lab 1 Objectives

When you have completed Lab 1, you will know:

- What file is included in a Zynq hardware platform archive and what the file contains

Experiment 1: Review the Hardware Platform Archive

This experiment shows where you will find the exported Zynq Hardware Platform within a Vivado project directory structure. The purpose of each file will be explained.

Experiment 1 General Instruction:

Browse the directory structure for the pre-built Zynq platform from Vivado. Review the archive that Vivado exported for SDK. Learn what the purpose of each file is.

Experiment 1 Step-by-Step Instructions:

1. Open Windows Explorer.

2. Browse to the provided, pre-built and pre-exported Zynq hardware platform within the Vivado project in the following folder:

For MicroZed 7010

C:\Speedway\ZynqSW\2016_2\ZynqDesign\MZ\7010\ZynqDesign.sdk

For MicroZed 7020

C:\Speedway\ZynqSW\2016_2\ZynqDesign\MZ\7020\ZynqDesign.sdk

For PicoZed 7010

C:\Speedway\ZynqSW\2016_2\ZynqDesign\PZ\7010\ZynqDesign.sdk

For PicoZed 7015

C:\Speedway\ZynqSW\2016_2\ZynqDesign\PZ\7015\ZynqDesign.sdk

For PicoZed 7020

C:\Speedway\ZynqSW\2016_2\ZynqDesign\PZ\7020\ZynqDesign.sdk

For PicoZed 7030

C:\Speedway\ZynqSW\2016_2\ZynqDesign\PZ\7030\ZynqDesign.sdk

For ZedBoard

C:\Speedway\ZynqSW\2016_2\ZynqDesign\ZB\ZynqDesign.sdk

This is the folder location where the Vivado project writes the hardware platform by default. The complete contents of this directory is a single **.hdf** file -- `Z_system_wrapper.hdf`. This file is a compressed file that contains the information to develop software applications within SDK. For hardware and software engineers working together, this file is the only required item to be transferred from the hardware team to the software team. For software engineers working exclusively in SDK, they do not need anything else from the rest of the Vivado project. The contents of the decompressed HDF are shown below.

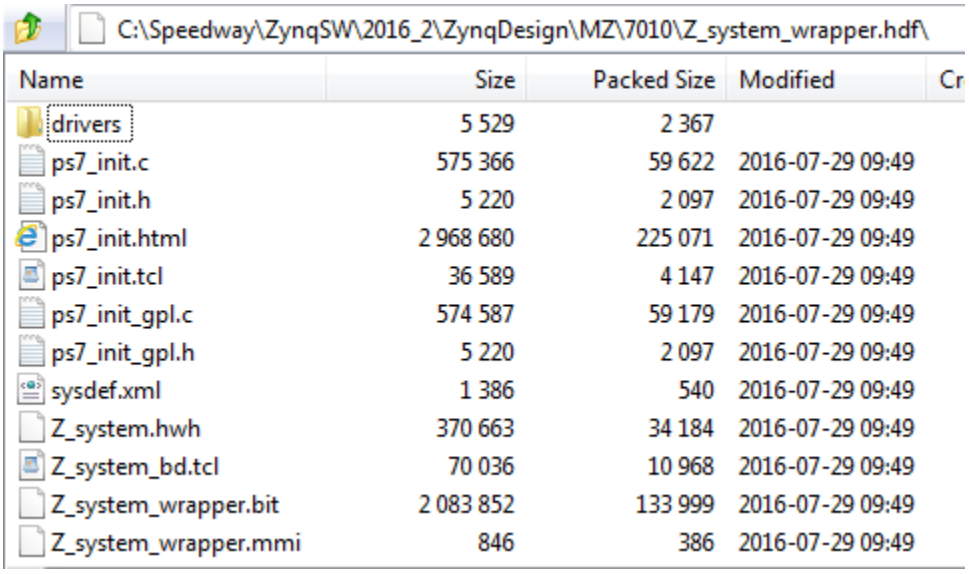

Figure 1 – Zynq Hardware Platform Export from Vivado contained in the .hdf

Here is a description of each file and its purpose.

ps7_init.c	C code file defining all the register settings to properly initialize the ARM processing system. Used to create the First Stage Boot Loader (FSBL) executable.
ps7_init.h	Header file used with ps7_init.c which is also used in the creation of the FSBL.
ps7_init.html	Information file that describes how the ARM processing system is configured in this hardware platform and what all the register settings are. This is the best file for a software engineer to first examine as it is the 'datasheet' for the hardware platform.
ps7_init.tcl	This is the equivalent of ps7_init.c, but in TCL format. This file performs the ARM initialization when using SDK in JTAG mode, such as when debugging.
ps7_init_gpl.c	Identical to ps7_init.c, with the exception of the header which highlights the GNU General Public License
ps7_init_gpl.h	Identical to ps7_init.h, with the exception of the header which highlights the GNU General Public License
PWM_w_Int.tcl	TCL file for generating parameters for the custom IP driver
sysdef.xml	System Definition XML, containing parameter definitions for each file contained within the archive
Z_system.hwh	Hardware Hand-off file
Z_system_bd.tcl	TCL file to re-create the Zynq PS7 Block Design
Z_system_wrapper.bit (<project>_wrapper.bit)	This is the PL configuration bitstream. This file is used to configure the PL, which gives the PL its function and identity. 'Z_system_wrapper' is the name of the top-level HDL file that the hardware designer used.
Z_system_wrapper.mmi	BRAM Memory Map Info file

Questions:

Answer the following questions:

- *What tool suite creates the Zynq hardware platform archive?*

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- *List all the things that a hardware engineer is required to deliver to a software engineer to develop Zynq applications:*

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Revision History

Date	Version	Revision
12 Nov 13	01	Initial release
22 Nov 13	02	Revisions after pilot
01 May 14	03	MicroZed.org Training Course Released
28 Oct 14	04	Revision for 2014.3
11 Dec 14	05	Revision for 2014.4
05 Jan 14	06	Minor typo correction
19 Mar 15	07	Finalize SDK 2014.4
Oct 15	08	Updated for 2015.2
Aug 16	09	Updated for 2016.2

Resources

www.microzed.org

www.picozed.org

www.zedboard.org

www.xilinx.com/zynq

www.xilinx.com/sdk

www.xilinx.com/vivado

www.xilinx.com/support/documentation/sw_manuals/ug949-vivado-design-methodology.pdf

www.xilinx.com/support/documentation/sw_manuals/ug1046-ultrafast-design-methodology-guide.pdf

Answers

Experiment 1

- *What tool suite creates the Zynq hardware platform archive?*

Vivado creates the Zynq hardware platform.

- *List all the things that a hardware engineer is required to deliver to a software engineer to develop Zynq applications:*

Only the HDF archive is required